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A SOVIET LIQUID OXYGEN DISTRIBUTION FACILITY
SUPPORTING SURFACE-TO-SURFACE MISSILE DEPLOYMENT
IN THE CARPATHIAN MILITARY DISTRICT



CIA/RR EM 61-4

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CENTRAL INTELLIGENCE AGENCY

Office of Research and Reports
Office of Scientific Intelligence
Office of Current Intelligence

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FOREWORD

This memorandum presents significant new information relating to ballistic missile deployment in the USSR. The memorandum examines in detail a liquid oxygen (LOX) facility in the Carpathian Military District. In addition, reference has been made to some of the other intelligence that may assist in estimating the significance of this installation in relation to the missile program of the USSR.

Additional reports will examine in greater detail other aspects of missile deployment in the Carpathian Military District.

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A SOVIET LIQUID OXYGEN DISTRIBUTION FACILITY
SUPPORTING SURFACE-TO-SURFACE MISSILE DEPLOYMENT
IN THE CARPATHIAN MILITARY DISTRICT*

Summary and Conclusions

Recent evidence of Soviet missile activity identifies a liquid oxygen (LOX) distribution facility supporting the Soviet ballistic missile deployment program, located at Kolchino (48°28' N - 22°46' E), 5 kilometers (km) northeast of Mukachevo (48°26' N - 22°45' E), in the Carpathian Military District (CMD). A substantial body of evidence provides numerous indications of a major missile deployment program underway in the CMD since 1958. Deployment of 700-nautical-mile (nm) missiles is believed to have occurred in the CMD during 1959. Soviet strategic requirements, test range activity, and estimated capabilities, however, indicate that units becoming operational in the CMD during 1960 probably would be equipped with 1,100-nm weapons.

Present estimates conclude that Soviet long-range missiles use LOX as an oxidizer in their propulsion systems. Consequently, large supplies of LOX, located conveniently for field units, are an essential element in the deployment program. Analysis of the activity at Kolchino indicates that a minimum of 1,500 metric tons** of LOX was unloaded at this facility during 1960. A total of 1,500 is sufficient to supply LOX for about 30 SS-5 (1,100-nm) missiles, including allowances for and losses from transportation, handling, and storage for 60 days. This quantity of LOX is too great to be required only

* The estimates and conclusions in this memorandum represent the best judgment of the contributing offices as of 1 December 1960.

** Tonnages are given in metric tons throughout this memorandum.

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for replacement of boil-off losses for deployed missiles. Because there are no alternative economic or military demands for these large quantities of LOX in the area, it is reasonable to conclude that the large quantities of LOX shipped into Kolchino in 1960 were initial stocks for the use of military units equipped with ballistic missiles, probably of 1,100-nm range, and that a substantial addition to the Soviet surface-to-surface missile program in the CMD acquired operational status during the latter part of 1960.

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I. Introduction

The Carpathian Military District (CMD) (see the map, Figure 1*) has long been suspected of missile deployment activity. Its location is well suited for the coverage of Western Europe and Asia Minor by medium-range ballistic missiles. Germany is within range of the SS-4 (700-nm) Soviet missile, and England, France, Italy, Greece, and Turkey are within range of the SS-5 (1,100-nm) missile.

a LOX distribution facility in the CMD.

considerable Soviet activity was taking place in the area.

This memorandum attempts to describe the facility and to assess the cumulative significance of these observations in the light of other relevant information.

II. Description of the LOX Facility at Kolchino

at a LOX distribution facility located at the small town of Kolchino (48°28' N - 22°46' E), 5 km from Mukachevo, on the road to Svalyava (48°35' N - 23°00' E). A plan view of the facility, as shown in Figure 2, ***

Figure 3*** shows a 1944 aerial photograph of the area with the outline of the Kolchino facility superimposed. Figure 4*** is a photograph of part of the facility. 2/ Aspects of the facility of particular interest include the following:

* Inside back cover.

*** Following p. 4.

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a. Security

1. Double fencing was seen on two sides (other sides not observed). 3/
2. One floodlight was photographed along the fence line. 4/
3. One watchtower was identified. 5/
4. Guards were observed on duty at an access road. 6/

b. Access

1. At least two, and probably more, rail spurs in the facility. ^
2. Highway access

c. Location

1. A large town with major rail facilities is located nearby.
2. The facility is near suspected locations of deployment sites.

d. Structures

1. Several buildings
2. One and possibly two covered bunkers, 3 to 5 meters high and 6 to 9 meters in diameter,
3. Two or three silver-colored cylinders, about 1 meter in diameter and 3 meters long,

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USSR: CARPATHIAN MILITARY DISTRICT

—+—+— Railroad
— Uzhgorod-L'vov Highways

0 50 100 Miles
0 50 100 Kilometers

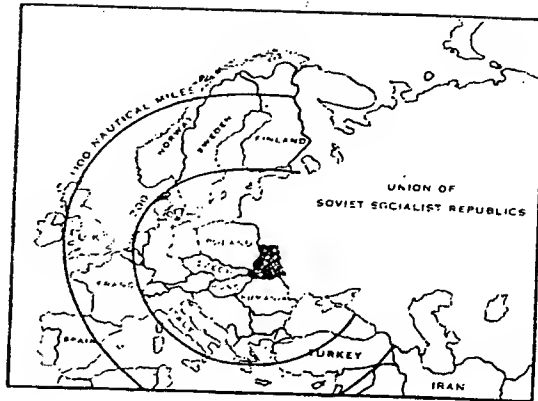
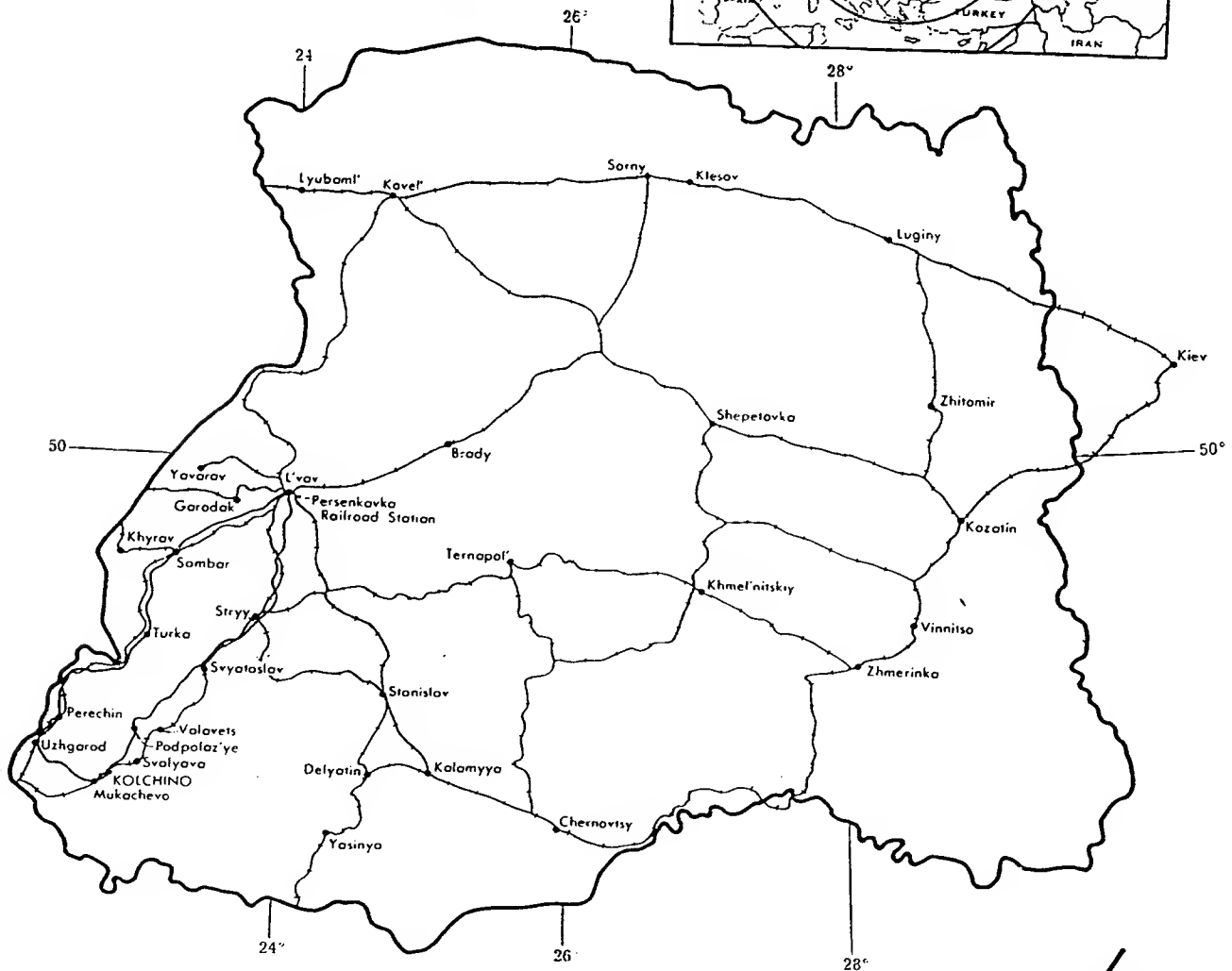
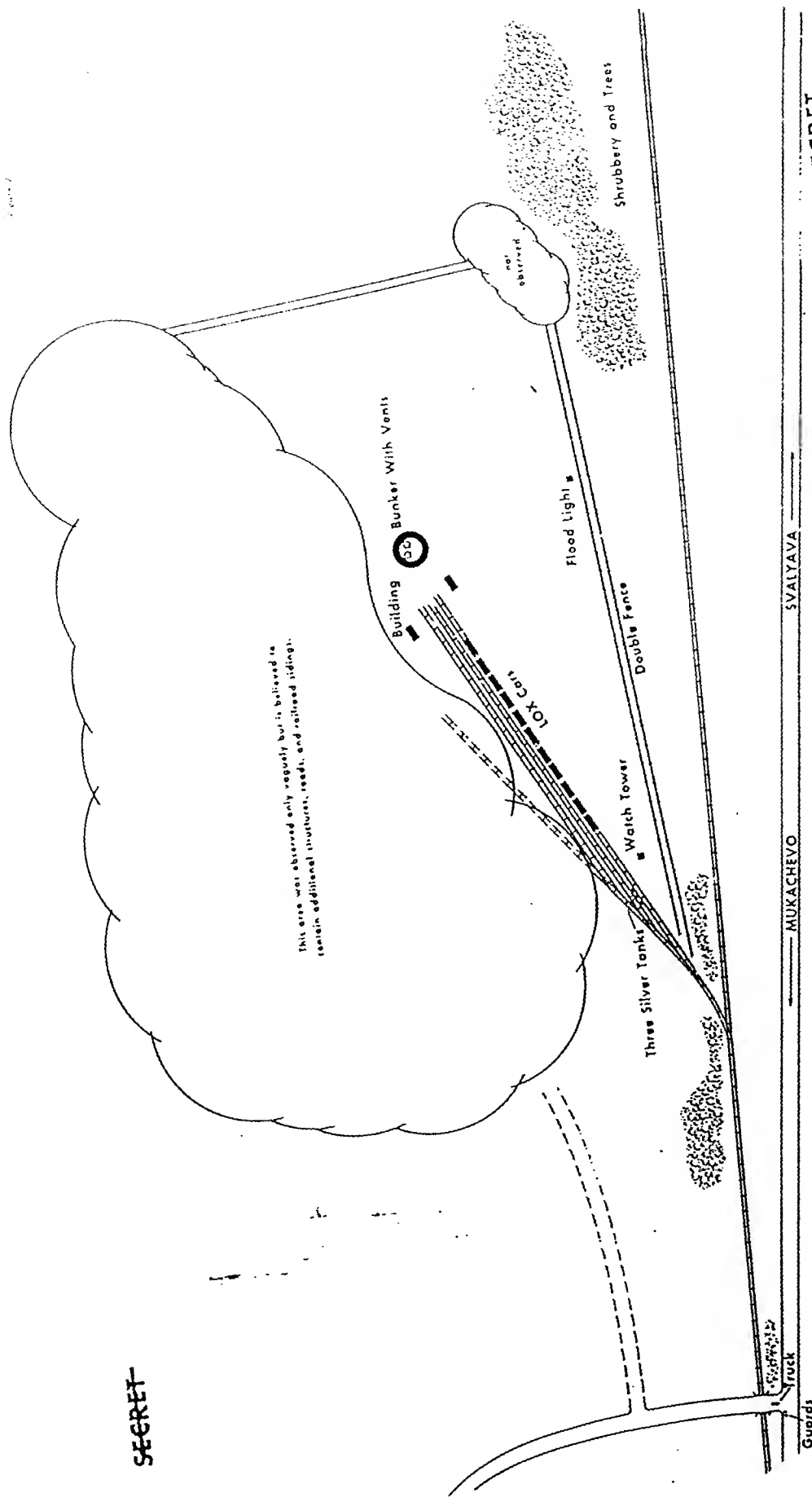


Figure 1



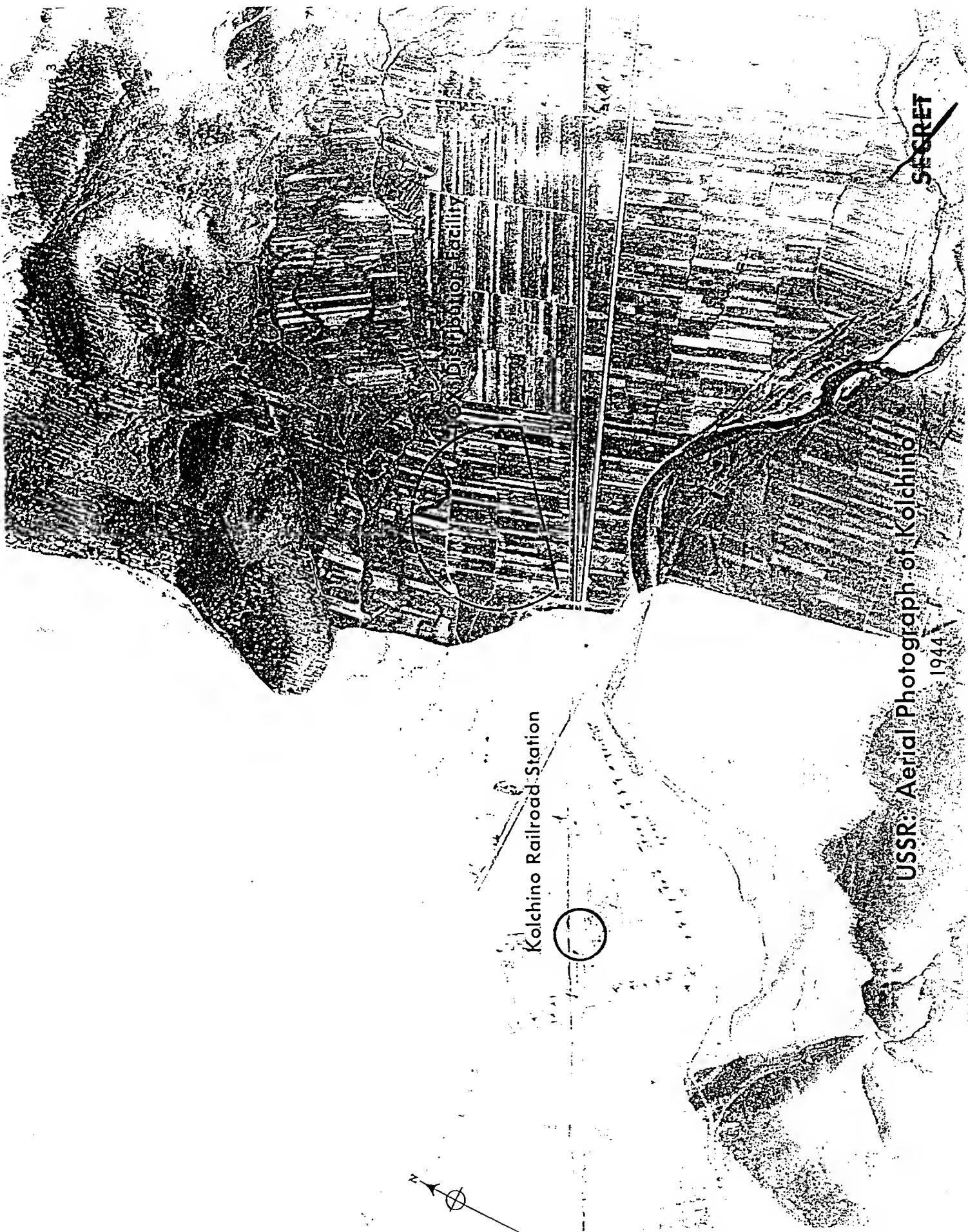
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USSR: LOX DISTRIBUTION FACILITIES AT KOLCHINO

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Kolchino Railroad Station

Distribution Facility

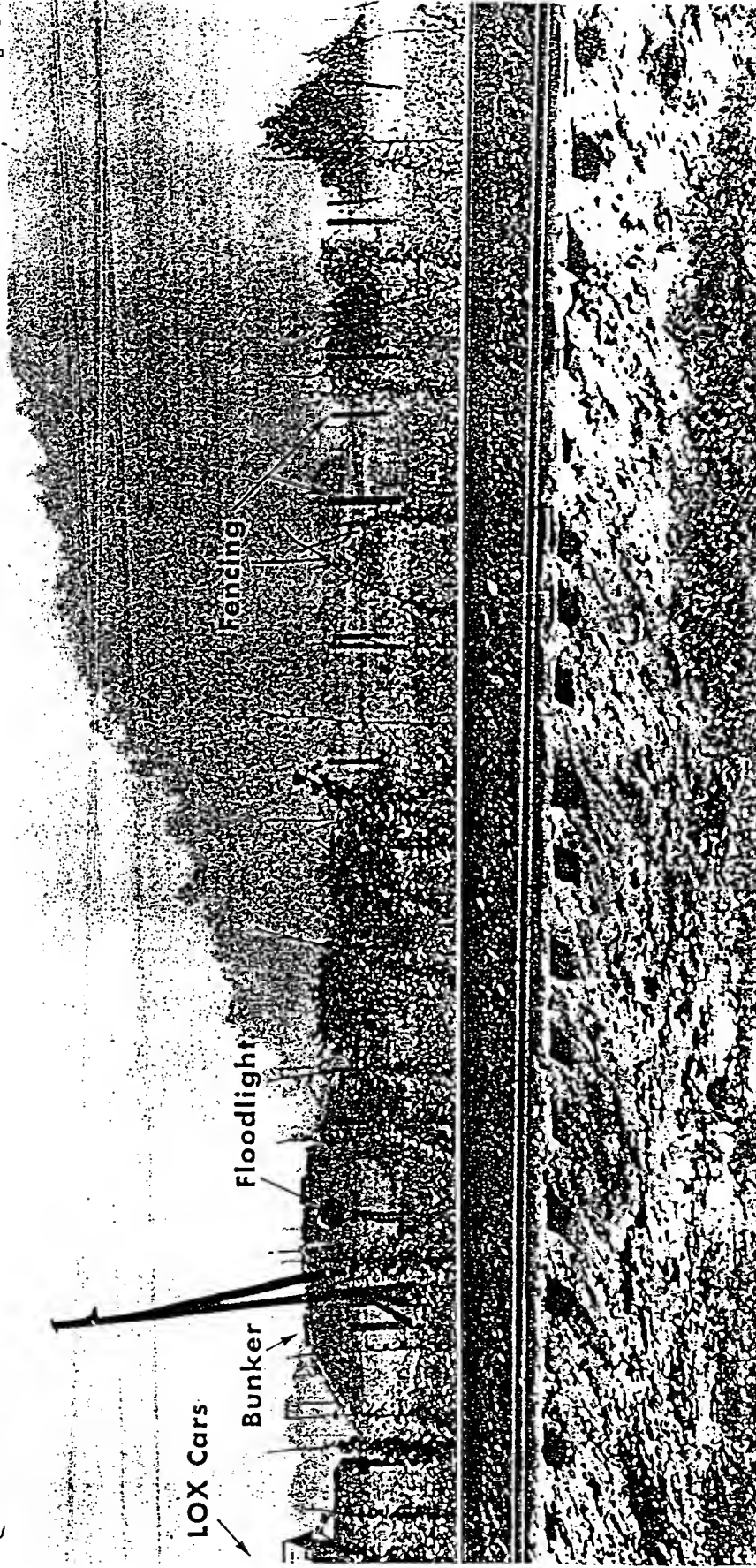
USSR: Aerial Photograph of Kolchino

1944

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Figure 4



USSR: FACILITIES AT KOLCHINO

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III. Activity Related to the LOX Facility

A. Shipments to the Facility

The principal activity appeared to be the handling of LOX being transported in Type I 15/ LOX cars (see Figure 5*). The nature of the installation combined with the fact that no LOX production facility is known to exist in the area indicates that the facility is probably an unloading point and storage facility. Because no large consumers of LOX are known to be in the Mukachevo area, it is likely that this installation is intended for use by deployed missile units. Observations of this facility, were as follows:

<u>Date</u>	<u>Number of Cars Observed</u>
-------------	--------------------------------

* Following p. 6.

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B. Quantity of LOX Shipped and Its Significance*

On the basis of the rated capacity of the cars of 32 tons, a figure of 1,500 tons is derived as the minimum quantity of LOX unloaded at the facility. It has been assumed that Soviet losses in transportation, handling, and storage of LOX are comparable to US experience -- that is, values of 2 percent per day in transit, 10 percent in transfer or loading, and 0.5 percent per day in storage of large quantities. On the basis of these factors, 1,500 tons of LOX are sufficient to permit a standby capability of 60 days for about 30 SS-5 missiles without replacement of boil-off losses. This computation also assumes a configuration of the SS-5 missile with a capacity of about 25 tons of LOX. If double propellant loading exercises are conducted by deployed units, evaporation losses would be greater than those used above. Because it would be wasteful to bring in the LOX for missile units before they are otherwise operationally capable, it is probable that the arrival of this quantity of LOX indicates that some missile units in the area were issued missiles.

C. Probable Supplier of LOX

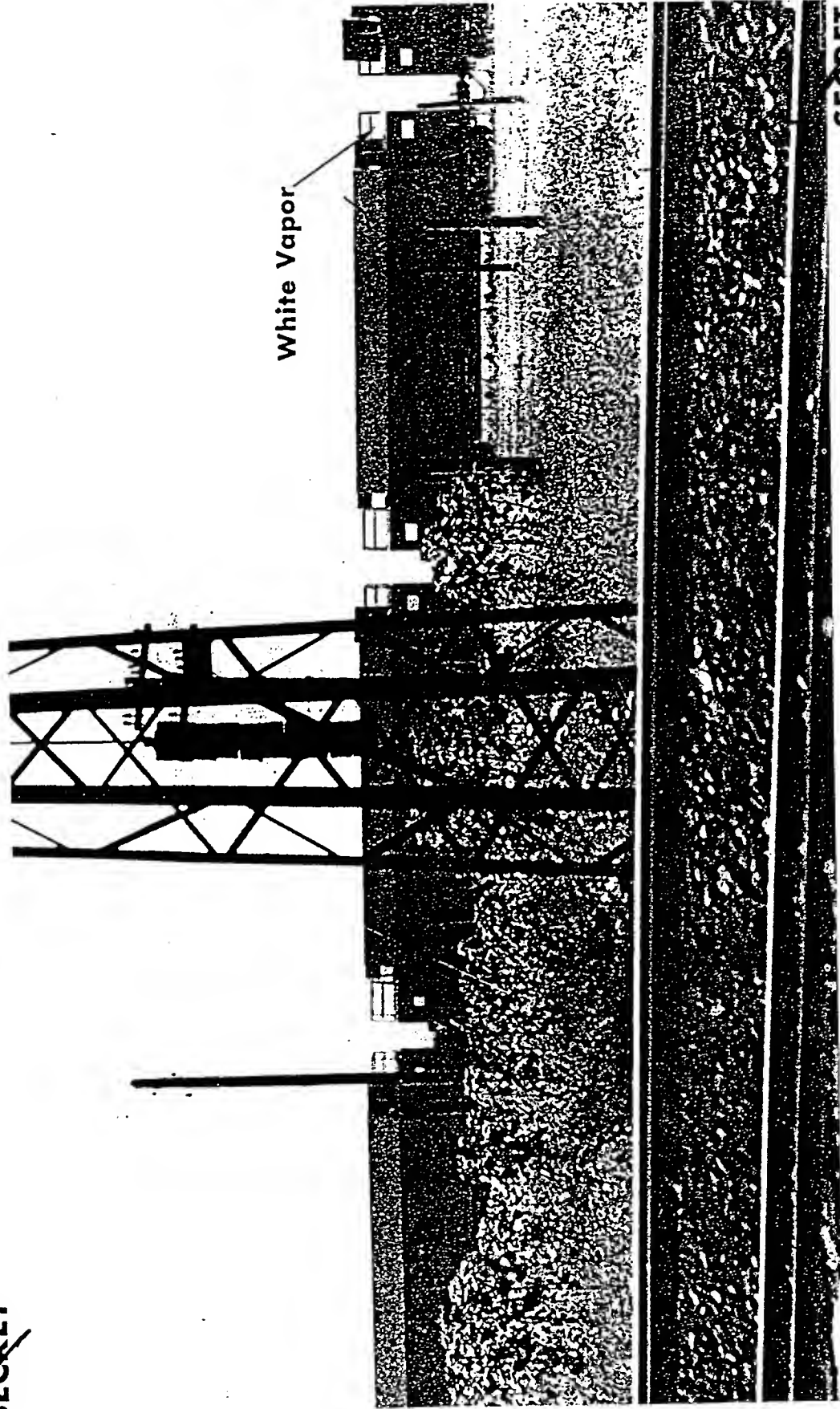
A likely production source for the shipments of LOX to Mukachevo is Plant No. 31 at Persenkovka, 3 km southeast of L'vov (49°50' N - 24°00' E). This LOX plant was reportedly built on a rush basis in 1953.

A description of the compressors indicates a production capacity of

* For a detailed explanation of calculations, see Appendix A.

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Figure 5



White Vapor

USSR: LOX CARS AT KOLCHINO

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about 100 tons of LOX per day in 1957. ^{28/} LOX cars have been reported in the rail yards at L'vov

Evidence indicates that production from this plant is consigned primarily to military use.

D. Area Supported by the Facility

The area supported by the Kolchino LOX distribution facility cannot be defined at present. The fact that neither LOX tank trucks nor provisions for removing the LOX from the facility were observed may indicate that the LOX is stored at the site. In any case, there probably is sufficient storage capacity to allow unloading of 11 cars, the largest number. If the LOX is stored at Kolchino, it would seem likely that the military units served are located nearby.

IV. Missile Deployment Activity in the Mukachevo Area

Since late 1956, have indicated sensitive military activity and storage, usually reported as being associated with missiles, in the Mukachevo region. ^{32/} The towns of Svalyava and Podplazi (48°44' N - 23°01' E) have been mentioned specifically. ^{33/} Special weapons storage is located at Stry (49°16' N - 23°48' E), 100 km to the north of Mukachevo.

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Recent identification of a surface-to-air missile site near Mukachevo may indicate that the USSR places priority on defending facilities in the Mukachevo area. 34/

of a type thought to be capable of carrying either the 700-nm or the 1,100-nm missile was reported on a route south from Kiev

it is possible that this sighting was of equipment for newly activated units in the Mukachevo area.

V. Relationship to the Guided Missile Program

The supplies of LOX to Kolchino probably are for the use of units equipped with surface-to-surface weapons. Estimates indicate that both the SS-4 (700-nm) and the SS-5 (1,100-nm) missiles were operationally available before

In consideration of the probability that the SS-4 missile was deployed in the Carpathian area in 1959 and the limited target coverage possible from the Carpathians with the 700-nm missile, it would be reasonable to expect the addition of SS-5 (1,100-nm) missile units to this area at the earliest feasible date. Therefore, it is probable that the large quantities of LOX shipped into Kolchino in 1960 were initial stocks for the use of military units equipped with 1,100-nm weapons. ✓

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APPENDIX A

METHODOLOGY

Detailed Analysis of LOX Activity at Kolchino

It has been possible to derive the quantity of LOX delivered and to assess the significance of this amount as related to the Soviet deployment program.

1. Quantity of LOX Delivered

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2. Significance of the Quantity of LOX

This computation assesses the significance of the quantity of LOX shipped to Kolchino as it would be likely to be used in the deployment of the SS-5(1,100-nm) missile. It is based on a typical sequence of events that might be expected to be required in order to move the LOX from the producer to the missile. In addition, provision is made for the USSR to maintain sufficient reserve in the vicinity of the launch positions or in the support area to permit storage for 60 days without replacement of boil-off losses.

On the assumptions that 2 days were spent in transit with a loss of 2 percent per day and that all losses were computed by taking successive daily remainders, the additional losses that occurred follow. A transfer to storage was made with a loss of 10 percent, storage was maintained for 60 days with a further loss of 0.5 percent per day, a transfer to local transport would be required with an additional loss of 10 percent, an additional loss of 2 percent would be experienced during transport to the site, and loading of the missile would result in a final loss of 10 percent -- the 1,472 delivered tons are reduced to about 745 tons available for final use. This computation assumes a 60-day storage period for each shipment of LOX.

the longer storage times of earlier shipments will mean slightly greater losses and will result in a figure of 702 tons of LOX available for final use.

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If a configuration for the SS-5 (1,100-nm) missile requiring 25 tons of LOX for propellant loading is used, the quantity shipped into Kolchino is sufficient to service 28 to 30 missiles for 60 days of storage without replacement of boil-off-losses.

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APPENDIX B

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

<u>Source of Information</u>	<u>Information</u>
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this memorandum. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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APPENDIX B

SOURCE REFERENCES

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